PATENT APPLICATION
Docket No. 1737.2.15

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants:	Walter E. Red et al.	)
		)
Serial No.:	10/823,465	)
		)
Filed:	April 13, 2004	)
		)
Title:	SYSTEMS AND METHODS FOR CONTROLLING	)
	AND MONITORING MULTIPLE ELECTRONIC	)
	DEVICES	)
		)
Examiner:	Jennifer L. Norton	)

Group Art
Unit: 2121

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

An Office Action dated May 23, 2008 rejected claims 1, 2, 4-12, 14-23 and 25-31 in the present application. A Notice of Appeal was submitted on September 23, 2008. Appellants' Appeal Brief is being filed herewith.

1. REAL PARTY IN INTEREST

The real party in interest is the assignee, Brigham Young University.

2. RELATED APPEALS AND INTERFERENCES

There are no related appeals and/or interferences.

3. STATUS OF CLAIMS

Claims 1, 2, 4-12, 14-23 and 25-31 are pending in the present application. Claims 1, 2, 4-12, 14-23 and 25-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,499,054 to Hesselink (hereinafter, "Hesselink") in view of U.S. Patent No. 6,028,412 to Shine (hereinafter, "Shine").

Appellants appeal the above rejections.

4. STATUS OF AMENDMENTS

No amendments were filed subsequent to the Office Action.

5. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention relates generally to controlling electronic devices, and more particularly, to controlling components (e.g., valves, sensors, motors, etc.) of electronic devices. Typically, control of electronic devices occurs locally at the device with the incorporated computer or microcontroller. Control and coordination of each device is usually implemented in dedicated, single purpose hardware. Each device typically has its own microcontroller, programmable logic controller, or servo card to perform the necessary servo control. Consequently, the control loops are typically closed in the control hardware at the device itself. For example, robots, appliances, HVAC systems, TV remotes, etc., all have a resident micro or servo-controller of various sizes and complexity. These controllers are hardware dedicated to the device and generally have a limited frequency range for the device being controlled.

The purpose of the claimed invention is to avoid this type of implementation. In accordance with claim 1, the "hardware controller" (e.g., microcontroller, programmable logic controller, servo card, etc.) at the controlled device is replaced with a "dumb" state board so that the control processes can be run from a central control unit ("the host device"). In particular, as recited in claim 1, the "host device ... execut[es] control software ... to generate control input parameters for ... controlled devices" and "send[s] the control input parameters to the ... controlled devices ... via ... frequency-based, real-time electronic communications."

Thus, in accordance with the claimed invention, it is not necessary to build dedicated, single-purpose hardware for each controlled device. This is advantageous for many reasons. An important advantage is that costs are significantly reduced. As another example, the claimed invention provides for flexibility in altering the way in which devices are controlled. With the claimed invention, when a change is desired, software at the host device can be modified instead of having to replace the hardware controller at each controlled device. In addition, programming interfaces, control wiring, and power electronics of the controlled devices are simplified as a result of the claimed invention.

It should also be noted that the use of the term "real-time" in connection with electronic communications over a network has a specific meaning in the claims. In particular, "real-time" means the following: each device is "assign[ed] ... a control frequency specific to that

controlled device," "control input parameters … are always sent to that controlled device at the assigned control frequency for that controlled device," and it is "ensur[ed] that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth."

As required by 37 C.F.R. § 41.37(c)(1)(v), a summary of claimed subject matter immediately follows. The references to the specification refer only to embodiments of the invention. The invention is defined by the claims. Accordingly, these references to the specification are not meant to limit the scope of the claims at issue in any way but are only provided because they are mandated by 37 C.F.R. § 41.37(c)(1)(v). All references are to the patent specification.

1.   A method for controlling one or more electronic devices (106) through a host device (104), the method comprising:

   establishing frequency-based, real-time electronic communications over a network (108) between the host device (104) and one or more controlled devices (106); (page 5, lines 26-27; page 8, lines 8-16)

   assigning each controlled device (106) a control frequency specific to that controlled device (106); (page 17, lines 9-11)

   executing control software (110) in the host device (104) to generate control input parameters (326) for the one or more controlled devices; (page 6, lines 8-11)

   sending the control input parameters (326) to the one or more controlled devices (106), wherein the control input parameters (326) for a particular controlled device (106) are always sent to that controlled device (106) at the assigned control frequency for that controlled device (106); and (page 10, lines 5-8)

   ensuring that the sum of all the control frequencies for the one or more controlled devices (106) does not exceed the network's bandwidth, so that electronic communication with each controlled device (106) always occurs at the assigned control frequency for that controlled device (106), thereby facilitating real-time communication with that controlled device (106); (page 16, lines 21-25)

wherein the one or more controlled devices (106) do not include a hardware controller for generating the control input parameters (326), but instead receive the control input parameters (326) from the host device (104) via the frequency-based, real-time electronic communications. (page 7, lines 4-6 and 9-13)

11. A computing device (104) configured for controlling electronic devices (106), the computing device (104) comprising:

a processor (634);

memory (640) in electronic communication with the processor (634); and

executable instructions executable by the processor (634), wherein the executable instructions are configured for:

establishing frequency-based, real-time electronic communications over a network (108) between the host device (104) and one or more controlled devices (106); (page 5, lines 26-27; page 8, lines 8-16)

assigning each controlled device (106) a control frequency specific to that controlled device (106); (page 17, lines 9-11)

executing control software (110) in the host device (104) to generate control input parameters (326) for the one or more controlled devices (106); (page 6, lines 8-11)

sending the control input parameters (326) to the one or more controlled devices (106), wherein the control input parameters (326) for a particular controlled device (106) are always sent to that controlled device (106) at the assigned control frequency for that controlled device (106); and (page 10, lines 5-8)

ensuring that the sum of all the control frequencies for the one or more controlled devices (106) does not exceed the network's bandwidth, so that electronic communication with each controlled device (106) always occurs at the assigned control frequency for that controlled device (106), thereby

facilitating real-time communication with that controlled device (106);
(page 16, lines 21-25)

wherein the one or more controlled devices (106) do not include a hardware controller for generating the control input parameters (326), but instead receive the control input parameters (326) from the host device (104) via the frequency-based, real-time electronic communications. (page 7, lines 4-6 and 9-13)

22. A computer-readable medium for storing program data, wherein the program data comprises executable instructions for:

establishing frequency-based, real-time electronic communications over a network (108) between the host device (104) and one or more controlled devices (106); (page 5, lines 26-27; page 8, lines 8-16)

assigning each controlled device (106) a control frequency specific to that controlled device (106); (page 17, lines 9-11)

executing control software (110) in the host device (104) to generate control input parameters (326) for the one or more controlled devices; (page 6, lines 8-11)

sending the control input parameters (326) to the one or more controlled devices (106), wherein the control input parameters (326) for a particular controlled device (106) are always sent to that controlled device (106) at the assigned control frequency for that controlled device (106); and (page 10, lines 5-8)

ensuring that the sum of all the control frequencies for the one or more controlled devices (106) does not exceed the network's bandwidth, so that electronic communication with each controlled device (106) always occurs at the assigned control frequency for that controlled device (106), thereby facilitating real-time communication with that controlled device (106); (page 16, lines 21-25)

wherein the one or more controlled devices (106) do not include a hardware controller for generating the control input parameters (326), but instead receive the control input parameters (326) from the host device (104) via the frequency-based, real-time electronic communications. (page 7, lines 4-6 and 9-13)

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following issues are presented for review:

A.   Whether claims 1, 2, 4-12, 14-23 and 25-31 are unpatentable under 35 U.S.C. § 103(a) over Hesselink in view of Shine.

7. ARGUMENT

A.   Claims 1, 2, 4-12, 14-23 and 25-31 Rejected under 35 U.S.C. § 103(a)

Claims 1, 2, 4-12, 14-23 and 25-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hesselink in view of Shine. This rejection is respectfully traversed.

Claims 1, 2, 5-12, 14-23 and 25-31

Claim 1 will be discussed initially.

Neither Hesselink nor Shine teaches or suggests that "the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications," as recited in claim 1. This is acknowledged by the Examiner in the Office Action. (*See* Office Action, page 3, lines 8 and 16-17, and page 4, lines 17-18.)

However, the Examiner asserts that "[i]t would have been obvious ... since it has been held that omission of an element *and its functions* in a combination where remaining elements perform the same function as before involves only routine skill in the art." (Office Action, page 4, line 18 – page 5, line 2; emphasis added.) Appellants strongly disagree. This is not a situation where "an element *and its functions*" are being omitted, as asserted by the Examiner. Rather, an element (the "hardware controller") is being omitted, but its functions are being performed by another element (the "host device via the frequency-based, real-time electronic communications"). Furthermore, there are several advantages to the elimination of the hardware controller at the controlled device, which the Examiner appears to be ignoring.

Typically, control of electronic devices is implemented in dedicated, single purpose hardware. Each device typically has its own microcontroller, programmable logic controller, or servo card to generate control input parameters and perform the necessary servo control. The purpose of the claimed method is to avoid this type of implementation. In accordance with claim 1, the "hardware controller" (e.g., microcontroller, programmable logic controller, servo card, etc.) at the controlled device is replaced with a "dumb" state board so that the control processes can be run from a central control unit ("the host device"). In particular, as recited in claim 1, the "host

device ... execut[es] control software ... to generate control input parameters for ... controlled devices" and "send[s] the control input parameters to the ... controlled devices ... via ... frequency-based, real-time electronic communications."

The method of claim 1 - in which it is not necessary to build dedicated, single-purpose hardware for each controlled device - is advantageous for many reasons. An important advantage is that costs are significantly reduced. As another example, the method of claim 1 provides for flexibility in altering the way in which devices are controlled. With the method of claim 1, when a change is desired, software at the host device can be modified instead of having to replace the hardware controller at each controlled device. In addition, programming interfaces, control wiring, and power electronics of the controlled devices are simplified as a result of the method of claim 1.

Eliminating the need to build dedicated, single-purpose hardware for each controlled device is not simply a matter of "omi[tting] ... an element and its functions," as asserted by the Examiner. Rather, it represents a fundamental change to the way that electronic devices are controlled. The method of claim 1 is clearly not obvious in view of Hesselink and Shine.

In addition, neither Hesselink nor Shine teaches or suggests "establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices," as recited in claim 1.

Appellant acknowledges that Hesselink uses the term "real-time." However, the term "real-time" has a different meaning in claim 1 than it has in Hesselink. Hesselink's use of the term "real-time" is not used appropriately in the context of frequency-based servo-control, but more accurately represents current or near-time. Hesselink's control network uses the conventional TCP/IP protocol. (*See* Hesselink, col. 4, lines 56-60.) A network that uses conventional TCP/IP is not a real-time network in the sense of controlling critical time dependent processes where the communication cycle must be exact and unvarying, as in controlling valves, sensors, motors, etc.

In claim 1, "real-time" means the following: each device is "assign[ed] ... a control frequency specific to that controlled device," "control input parameters ... are always sent to that controlled device at the assigned control frequency for that controlled device," and it is

"ensur[ed] that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth." The Examiner acknowledges that Hesselink does not teach or suggest these requirements. (*See* Office Action, page 3, lines 8-13.) If Hesselink does not teach or suggest these requirements, then Hesselink does not teach or suggest "real-time electronic communications" within the meaning of claim 1.

Shine also does not teach or suggest all of the requirements for "real-time electronic communications" within the meaning of claim 1. In particular, Shine does not teach or suggest "ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth," as required by claim 1. The Examiner asserts that this element is taught by Shine at col. 3, lines 18-25. (*See* Office Action, page 4, lines 6-9.) Appellants respectfully disagree. The cited portion of Shine does not say anything at all about the "network's bandwidth." In fact, the term "bandwidth" is not used anywhere in Shine.

The Examiner appears to be using Appellants' own definition of "real-time communication" against Appellants for the purposes of establishing the rejection under § 103. (*See* Office Action, page 4, lines 11-14.) This is a clear example of improper hindsight reasoning. (*See* MPEP § 2142, which states that "impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art"). The Examiner should not be allowed to compensate for deficiencies in Shine's disclosure by referring to Appellants' own specification. The fact is that neither Hesselink nor Shine teach or suggest the "frequency-based, real-time electronic communications" that are recited in claim 1.

For at least the foregoing reasons, Appellants respectfully submit that claim 1 is allowable. In addition, claims 2, 5-12, 14-23, and 25-31 are allowable for at least the same reasons.
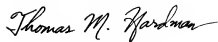
Claim 4

Neither Hesselink nor Shine teach or suggest "the control frequency is assigned using a 2^N time slicing algorithm, … wherein each control frequency that is assigned has a value of 2^N, further comprising establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the 2^N time slicing algorithm," as recited in claim 4. The Examiner correctly acknowledges that Hesselink does not teach or suggest this claimed subject matter. (Office Action, page 6, line 18 - page 7, line 4.) However, the Examiner asserts that this claimed subject matter is taught by Shine. Appellants respectfully disagree.

Shine teaches the use of 2^N frequencies for comparing accumulated frequencies to desired frequencies, because bitwise comparisons are simplified using multiples of 2 in integrated circuits. However, Shine does not teach or suggest that the "control frequency" that is "assign[ed]" to a controlled device is "assigned using a 2^N time slicing algorithm," as required by claim 4. Shine also does not teach or suggest the control of "a plurality of controlled devices" from one host device at the same time with the devices having differing control frequencies (i.e., "a discrete control frequency for each controlled device"). Shine also does not teach or suggest that only frequencies of value 2^N are generated, or that the devices to be controlled must operate at only frequencies specified by 2^N, as required by claim 4 ("assigning a discrete control frequency for each controlled device using the 2^N time slicing algorithm").

For at least the foregoing reasons, Appellants respectfully submit that claim 4 is allowable.

Respectfully submitted,

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CLAIMS APPENDIX

Listing of Claims involved in the appeal:

1.   A method for controlling one or more electronic devices through a host device, the method comprising:

      establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices;

      assigning each controlled device a control frequency specific to that controlled device;

      executing control software in the host device to generate control input parameters for the one or more controlled devices;

      sending the control input parameters to the one or more controlled devices, wherein the control input parameters for a particular controlled device are always sent to that controlled device at the assigned control frequency for that controlled device; and

      ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth, so that electronic communication with each controlled device always occurs at the assigned control frequency for that controlled device, thereby facilitating real-time communication with that controlled device;

      wherein the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications.

2.   The method of claim 1, further comprising receiving, at the host device, output parameters from the controlled devices in response to the control input parameters.

4.   The method of claim 1, wherein the control frequency is assigned using a 2^N time slicing algorithm, where N is a non-negative integer, wherein each control frequency that is assigned has a value of 2^N, further comprising establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the 2^N time slicing algorithm, where N is a non-negative integer.

5.   The method of claim 4, wherein N is independently determined for each controlled device of the plurality of the controlled devices.

6.   The method of claim 4, wherein the 2^N time slicing algorithm comprises assigning the control frequency at 2^N hertz, where N is a non-negative integer that will yield a discrete control frequency in proximity to a preferred control frequency of each controlled device.

7.   The method of claim 1, further comprising initiating a control loop process on the host device when electronic communication is established with a controlled devices.

8.   The method of claim 1, further comprising accessing the host device from a remote computing device via the Internet.

9.   The method of claim 8, further comprising providing information relating to the controlled devices to a user at the remote computing device.

10.   The method of claim 9, further comprising receiving user input at the host device from

the user at the remote computing device, wherein the input relates to the controlled devices.

11.   A computing device configured for controlling electronic devices, the computing device

comprising:

    a processor;

    memory in electronic communication with the processor; and

    executable instructions executable by the processor, wherein the executable instructions

        are configured for:

        establishing frequency-based, real-time electronic communications over a

            network between the host device and one or more controlled devices;

        assigning each controlled device a control frequency specific to that controlled

            device;

        executing control software in the host device to generate control input parameters

            for the one or more controlled devices;

        sending the control input parameters to the one or more controlled devices,

            wherein the control input parameters for a particular controlled device are

            always sent to that controlled device at the assigned control frequency for

            that controlled device; and

        ensuring that the sum of all the control frequencies for the one or more controlled

            devices does not exceed the network's bandwidth, so that electronic

            communication with each controlled device always occurs at the assigned

control frequency for that controlled device, thereby facilitating real-time communication with that controlled device;

wherein the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications.

12.   The computing device of claim 11, wherein the executable instructions are also configured for receiving, at the computing device, output parameters from the controlled devices in response to the control input parameters.

14.   The computing device of claim 11, wherein the control frequency is assigned using a 2^N time slicing algorithm, where N is a non-negative integer, wherein each control frequency that is assigned has a value of 2^N, wherein the executable instructions are also configured for establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the 2^N time slicing algorithm, where N is a non-negative integer.

15.   The computing device of claim 14, wherein N is independently determined for each controlled device of the plurality of controlled devices.

16.   The computing device of claim 14, wherein the 2^N time slicing algorithm comprises assigning the control frequency at 2^N hertz, where N is a non-negative integer that will yield a discrete control frequency in proximity to a preferred control frequency of the controlled device.

17.   The computing device of claim 11, wherein the executable instructions are also configured for initiating a control loop process on the computing device when electronic communication is established with a controlled device.

18.   The computing device of claim 17, wherein the executable instructions are also configured for initiating a torque/current control loop process at a microcontroller on the controlled device when the controlled device comprises a motor.

19.   The computing device of claim 11, wherein the executable instructions are also configured for accessing the computing device from a remote computing device via the Internet.

20.   The computing device of claim 19, wherein the executable instructions are also configured for providing information relating to the controlled devices to a user at the remote computing device.

21.   The computing device of claim 20, wherein the executable instructions are also configured for receiving user input at the computing device from the user at the remote computing device, wherein the input relates to the controlled devices.

22. A computer-readable medium for storing program data, wherein the program data comprises executable instructions for:

establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices;

assigning each controlled device a control frequency specific to that controlled device;

executing control software in the host device to generate control input parameters for the one or more controlled devices;

sending the control input parameters to the one or more controlled devices, wherein the control input parameters for a particular controlled device are always sent to that controlled device at the assigned control frequency for that controlled device; and

ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth, so that electronic communication with each controlled device always occurs at the assigned control frequency for that controlled device, thereby facilitating real-time communication with that controlled device;

wherein the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications.

23.   The computer-readable medium of claim 22, wherein the executable instructions are also configured for receiving, at the computing device, output parameters from the controlled device in response to the control input parameters.

25.   The computer-readable medium of claim 22, wherein the control frequency is assigned using a 2^N time slicing algorithm, where N is a non-negative integer, wherein each control frequency that is assigned has a value of 2^N, wherein the executable instructions are also configured for establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the 2^N time slicing algorithm, where N is a non-negative integer.

26.   The computer-readable medium of claim 25, wherein N is independently determined for each controlled device of the plurality of controlled devices.

27.   The computer-readable medium of claim 25, wherein the 2^N time slicing algorithm comprises assigning the control frequency at 2^N hertz, where N is a non-negative integer that will yield a discrete control frequency in proximity to a preferred control frequency of the controlled device.

28.   The computer-readable medium of claim 22, wherein the executable instructions are also configured for initiating a control loop process on the computing device when electronic communication is established with a controlled device.

29.   The computer-readable medium of claim 22, wherein the executable instructions are also configured for accessing the computing device from a remote computing device via the Internet.

30.   The computer-readable medium of claim 29, wherein the executable instructions are also configured for providing information relating to the controlled devices to a user at the remote computing device.

31.   The computer-readable medium of claim 30, wherein the executable instructions are also configured for receiving user input at the computing device from the user at the remote computing device, wherein the input relates to the controlled devices.

EVIDENCE APPENDIX

NONE.

<u>RELATED PROCEEDINGS APPENDIX</u>

NONE.